

 Independent Verification & Validation Facility	Software and Hardware Configuration Management	IVV 10 Revision: BASIC Effective Date: 7/28/2005
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APPROVAL SIGNATURES		DATE
Gregory Blaney (original signature on file)	Management System Representative	7/26/2005

REVISION HISTORY			
Rev. No.	Description of Change	Author	Effective Date
Basic	Initial Release	Roger Harris	7/28/2005

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REFERENCE DOCUMENTS	
Document Number	Document Title
NPD 7120.4C	Program/Project Management
NPR 7120.5C	NASA Program and Project Management Processes and Requirements

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1.0 Purpose

The purpose of this system level procedure (SLP) is to define configuration management (CM), its constituent functions, processes and procedures, and how Facility Management determines and applies CM to NASA IV&V Facility projects. This SLP also provides a basis for tailoring CM for different program/projects with different life cycles and specific requirements in accordance with NASA Procedural Requirement (NPR) 7120.5C, NASA Program and Project Management Processes and Requirements.

2.0 Scope

This SLP defines the CM requirements that apply to internally managed NASA projects and initiatives, as defined by the Associate of Operations. Examples are the NASA IV&V Facility Tools Laboratory (Tools Lab) servers and tools, as well as desktop applications and hardware, the security and badge systems, and tools such as the Resource Management Office (RMO) and Tools Lab web sites. Approved program plans shall be maintained under configuration control in accordance with NASA Policy Directive (NPD) 7120.4C, Program/Project Management. This SLP applies to the following entities:

1. The Associate of Operations
2. The Responsible Manager or Configuration Management Officers (CMOs)
3. Engineering Staff

3.0 Definitions and Acronyms

3.1 Baseline

A Baseline is a configuration of hardware, software, or systems at a discrete point in time in its life cycle.

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3.2 Configuration

A Configuration is the functional and/or physical characteristics of hardware, software, or systems as set forth in technical documentation, and realized in a product.

3.3 Configuration Authentication

Configuration Authentication is the process of verifying that a deliverable hardware, software, or system Baseline contains all of the items, which are required for delivery. Configuration Authentication also ensures that these items have been verified and satisfy their requirements.

3.4 Configuration Control

Configuration Control is the process of evaluating, coordinating, and deciding on the disposition of proposed changes to the Configuration Items. Configuration Control also governs the implementation of approved changes to baselined systems, hardware, software, and associated documentation.

3.5 Configuration Control Board (CCB)

The CCB is appointed by the Responsible Manager. The CCB approves changes to the Baseline.

3.6 Configuration Identification

Configuration Identification is the process of defining each Baseline to be established during the hardware, software, or system life cycle. It describes the Configuration Items and their documentation that make up each Baseline.

3.7 Configuration Item

A Configuration Item refers to each of the locally related components that make up some discrete element of the product.

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3.8 Configuration Librarian

The Configuration Librarian is the NASA IV&V Facility civil service employee or contractor responsible for maintaining the Configuration Library of the project.

3.9 Configuration Library

The Configuration Library is the location, either physically or logically, that contains all CM information for a project.

3.10 Configuration Management (CM)

CM is the process of identifying the configuration of the product at discrete points in time. CM is also the systematic control of changes to the identified configuration for the purpose of maintaining product integrity and traceability throughout the product life cycle. CM consists of four processes:

1. Configuration Identification
2. Configuration Control
3. Configuration Status Accounting
4. Configuration Authentication

3.11 Configuration Management Officer (CMO)

The CMO is the NASA IV&V Facility civil service employee or contractor having responsibility for managing the CM process for the Responsible Manager.

3.12 Configuration Management Plan (CMP)

The CMP is the document written by the Responsible Manager or CMO that demonstrates how the project will follow the CM process.

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3.13 Configuration Status Accounting

Configuration Status Accounting is a process used to trace changes to the hardware, software, or system.

3.14 Engineering Staff

The Engineering Staff is a group of NASA IV&V Facility civil service employees or contractors designated by the Responsible Manager to design, test, implement, and verify changes to a baselined project.

3.15 Responsible Manager

The Responsible Manager is the NASA IV&V Facility civil service employee having the responsibility and authority to accomplish/implement a specific activity or process, (e.g., organizational line managers, project managers).

3.16 Shall

The use of this word means the action described is mandatory.

3.17 Will

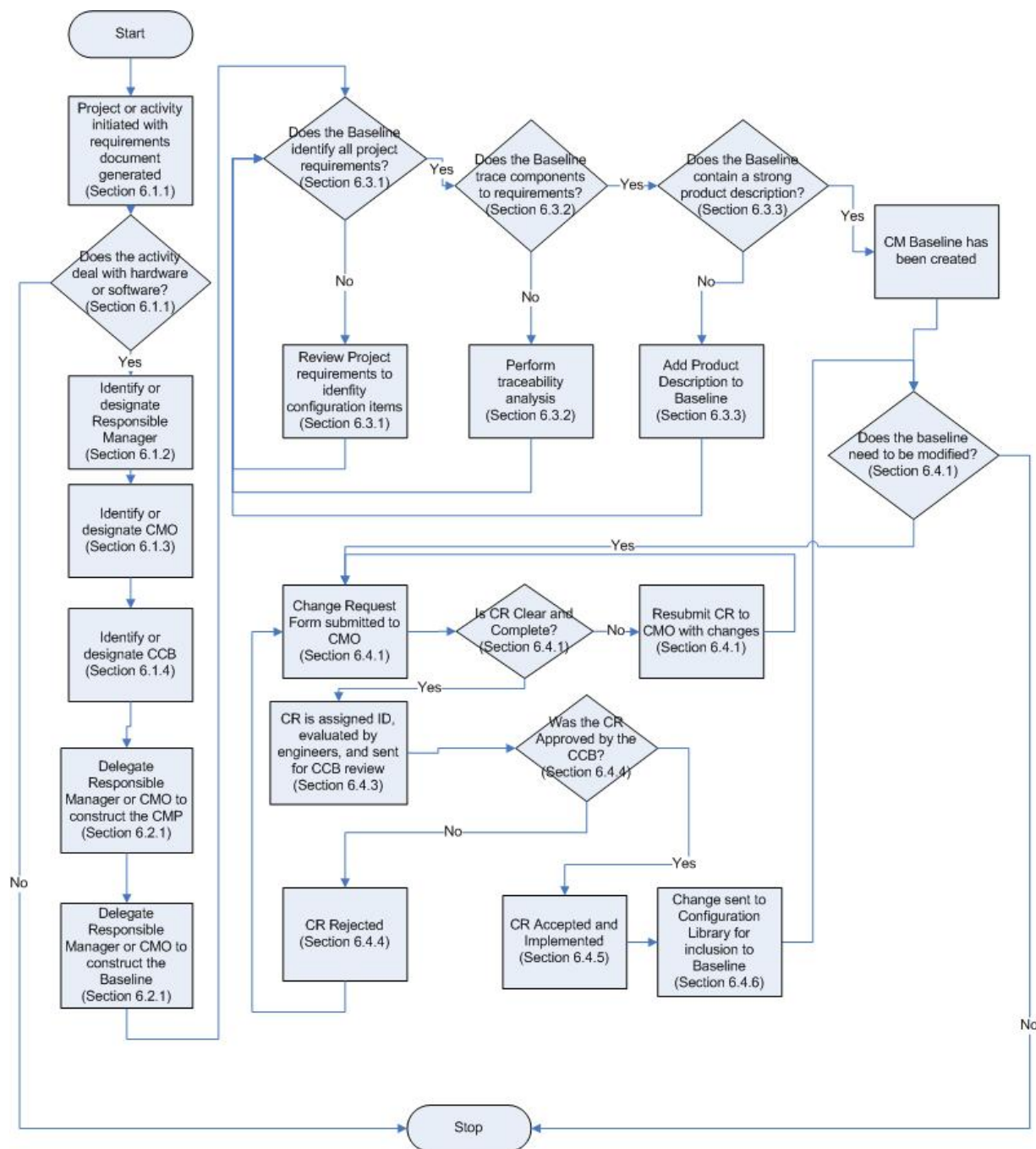
The use of this word shows intent.


3.18 Acronyms

CCB	Configuration Control Board
CM	Configuration Management
CMO	Configuration Management Officer
CMP	Configuration Management Plan
CR	Change Request
FCA	Functional Configuration Audit
GPG	Goddard Procedures and Guidelines
GPR	Goddard Procedural Requirements
PCA	Physical Configuration Audit
RMO	Resource Management Office
SLP	System Level Procedure
WI	Work Instruction



4.0 Flow Chart



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5.0 Responsibilities

5.1 Associate of Operations

The Associate of Operations shall:

- Ensure that a Responsible Manager is identified for a new or existing project.
- Ensure that the Responsible Manager creates and follows an appropriate CMP for that project.

5.2 Responsible Manager

The Responsible Manager shall:

- Write the CMP or ensure that CMP is written.
- Ensure that the level of CM specified in the CMP is appropriate.
- Grant exceptions to the CM process based on individual project/program needs or budgetary concerns.
- Ensure that CM processes are established and utilized.
- Appoint a CMO.

5.3 Configuration Management Officer (CMO)

The CMO shall:

- Operate the CM process.
- Maintain Configuration Control over the evolving products.
- Write or help write the CMP.
- Set up the program/project change control process.
- Process change requests (CRs) to the configuration Baseline established by the CMO or the Responsible Manager.
- Act as secretary for the program/project CCB.
- Produce and distribute periodic status accounting reports.

In the absence of a Configuration Librarian, the CMO shall:

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- Control and store all products (i.e., drawings, specifications, and software), both electronic and hard copy.
- Accept code, data files, and other components of Baselines, and file them in secure storage.
- Issue working copies to developers for authorized changes.
- Keep records and historical copies (either hard or electronic copy) of all versions of the components of Baselines.

5.4 Configuration Control Board (CCB)

The CCB shall:

- Review and disposition proposed changes to baselined requirements and deliverable products.
- Assign final change classification.

5.5 Configuration Librarian

The Configuration Librarian shall:

- Control and store all products (i.e., drawings, specifications, and software), both electronic and hard copy.
- Accept code, data files, and other components of Baselines, and file them in secure storage.
- Issue working copies to developers for authorized changes.
- Keep records and historical copies (either hard or electronic copy) of all versions of the components of Baselines.

5.6 Engineering Staff

The Engineering Staff shall:

- Design, test, implement, and verify approved CRs.

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6.0 Procedures

6.1 Application of CM to Project

6.1.1 Project Initiation

The initiator of a project will determine whether CM will be used on the project. If it is determined that the project falls under the scope of this SLP (the project is being managed by NASA, the stakeholders are internal to IV&V, and there will be a software and/or hardware component to the project with defined requirements), CM shall be applied to the project.

6.1.2 Responsible Manager

The initiator will identify or designate a Responsible Manager for the purposes of CM. Typically, this will be the same person as the initiator.

6.1.3 Configuration Management Officer (CMO)

The Responsible Manager will identify or designate a CMO to direct the CM effort for the project.

6.1.4 Configuration Control Board (CCB)

The Responsible Manager will identify or designate the CCB. The CCB is a working group consisting of representatives from the various disciplines and organizations of the developing project. However, for small projects the CCB may consist of only a single person, with approval from the Responsible Manager. The Responsible Manager or designee shall be the CCB chairperson.

Initially, the CCB should be made up of all immediate stakeholders, including the Responsible Manager, the CMO, and representatives from affected contractors, if applicable. If necessary, the Responsible Manager may add more personnel to the CCB.

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6.2 Configuration Management Plan (CMP)

6.2.1 Configuration Plan Development

Configuration Management (CM) activities for deliverable products shall be documented in a CMP or Project Plan. The Responsible Manager will determine whether or not a separate CMP is required for aspects of the project. The CMP may be written by either the Responsible Manager or by the CMO. The CMP will address the requirements of the Configuration Identification, Configuration Control, Configuration Status Accounting, and Configuration Authentication as appropriate. Any boards (e.g., CCB) shall have their roles, responsibilities, and membership defined within either the CMP or procedures referenced in the CMP.

The first version of the CMP should be written at the beginning of the project. The CMP details the personnel responsible for each role, defines the Configuration Items, and references the guides, procedures, and work instructions (WIs) to be followed.

The Responsible Manager defines the CMP scope. This scope will declare the classification of the level of effort required to maintain the CMP. The levels of effort are defined as:

- Low - undertaken in the event that the effort has a small number of stakeholders and a low number of internally interfaced customers
- Medium – undertaken if there is a small number of stakeholders and roughly the same number of internally and externally interfaced customers
- High - undertaken if there is a large number of stakeholders, and the project will target a high number of externally interfaced customers.

Because of the subjective nature of these values, the Responsible Manager should seek guidance from and the consent of Facility Management in ensuring that the CMP is viable.

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6.2.2 CMP Approval and Distribution

The Responsible Manager and Associate of Operations shall approve the CMP. The approved CMP establishes the CM Baseline requirements for the deliverable product. The Responsible Manager shall baseline the project, make available the authorized CMP or Project Plan, including CM requirements, to all members of the development effort, and issue detailed plans and tasks to individuals as appropriate. Once approved, the CMP establishes the CM requirements for the deliverable hardware, software, or system.

6.3 Configuration Identification

6.3.1 Configuration Item Selection

Hardware, software, or a system shall be grouped into Configuration Items for the Baseline. Each Configuration Item will be treated as an independent entity as far as the CM system is concerned. As a general rule, a Configuration Item is established for a separable piece of the hardware, software, or system that can be designed, implemented, and tested independently.

Division of the product into Configuration Items may be specified in the customer agreement or may be accomplished by the developers during requirements definition and analysis. The Configuration Item selection will be complete by the end of the preliminary design phase.

6.3.2 Identification and Traceability

Where appropriate, each product component shall be uniquely identified in the Baseline. This identifier shall be used in tracking and reporting the component's status. Suitable means of identification shall be used throughout all stages of production, delivery, and installation. The designation specifications, drawings, code, parts, and components shall include traceability of individual product or batches. The unique identification of products or batches requiring traceability shall be documented as a record.

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The specific records for a program/project shall be defined in the CMP.

6.3.3 Product Description

Hardware, software, or system components will be described in specifications and drawings in the Baseline. The descriptions of the components will become more detailed as the design and development proceeds through the life cycle.

6.4 Configuration Control

6.4.1 Change Initiation

Each project or organization shall establish a method for processing CRs. Project change control will commence for products or their descriptions (e.g., drawings, specifications) after their initial approval. A CR may be submitted by a user, a customer, a reviewer, or by any other member of the program/project staff. A project customer, the Engineering Staff, the Responsible Manager, or the CMO shall establish a CR form that documents a proposed change and its disposition.

The CMO will receive the CRs and review them for clarity and completeness. If the CMO determines that the CR is not complete, the CMO will return the CR to the originator. Once the CR is complete, the CMO assigns the CR a unique identifier for tracking purposes and records information about the CR in the CR tracking database or files.

6.4.2 Change Classification

Changes to hardware, software, or systems and associated documentation shall be classified according to the impact of the change and the approval authority needed. The following is an example of a classification scheme:

- Class 1 is assigned to changes that would affect the system level requirements, external interfaces, system cost, and/or

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delivery schedule. The CCB and Responsible Manager will approve these changes.

- Class 2 is assigned to changes that affect the interfaces between Configuration Items and the allocation of functions to Configuration Items, or to changes that affect component level of cost and scheduling. The Responsible Manager may approve these changes with or without the CCB.
- Class 3 changes are those that affect Configuration Item internal design and functionality. Project personnel may approve these changes.

The individual who proposes the change may suggest a change classification. The CMO reviews the suggested classification and assigns a working classification. After assessment of the impact of the CR, the CCB will assign the final classification.

6.4.3 Change Evaluation

Each change shall be analyzed for its impact on safety, reliability, maintainability, system functionality, interfaces, cost, schedule, and customer requirements. The CMO routes the CR to the Engineering Staff for evaluation. The Engineering Staff analysis will produce documentation that describes the changes that will have to be made to implement the CR, the Configuration Items and documents that will have to be changed, and the resources needed to do the change. This documentation becomes part of the change package. After completion of the analysis, the change package is returned to the CMO.

6.4.4 Change Disposition

The CCB shall disposition changes to baselined items. Membership and responsibilities for the CCB will be defined in the CMP. The CCB will approve, disapprove, returned for further analysis or information, or defer a CR.

Once a CR is dispositioned, it is sent to the CMO for action. Rejected items are returned to the originator along with the CCBs rationale for rejection. CRs needing further analysis are returned to

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the analysis group with the CCB's questions or requests attached. Deferred CRs are filed and sent back to the CCB at the proper time. Approved CRs are sent to the Engineering Staff.

The CMO is the secretary of the CCB; as such, the CMO prepares and distributes the meeting minutes and records the current status of the CR. This information will be added to the tracking database or recorded in files.

6.4.5 Change Implementation

Approved CRs are used as a change authorization form. The Engineering Staff schedules the resources to make the change. Official copies of the Baseline components to be changed are obtained from the Configuration Library. Associated documentation has to be revised to reflect the change. Once the change has been made and testing is completed, the revised component and documents are returned to the control of the Configuration Library.


6.4.6 Change Verification

The implemented changes shall be verified (this will usually occur at the Configuration Item level). This may require the rerun of tests specified in the test plan or the development of additional test documentation. For software changes, regression testing will usually have to be included in the test to assure that errors have not been introduced in existing functions by the change. Once verification is complete, the Engineering Staff shall submit evidence of the change to the Configuration Library. The Configuration Library will then include the changed items in the new version of the Baseline.

After the successful implementation and testing of the change described in the CR, the CMO will record the occurrence of this process into the CR tracking database or files.

6.4.7 Baseline Change Control

Changes to hardware, software, or systems are not complete until

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the changes have been implemented, tested, documented, and verified.

6.5 Configuration Status Accounting

Configuration Status Accounting establishes the record and status of the evolving product throughout its life cycle. It will provide traceability of changes to the baselined requirements, design, code and data, and associated documentation. It documents each version of the product and the changes that lead up to that version. It tracks the changes and contents of products, including their versions and releases. It defines the as-built configuration of the deliverable product.

Configuration Status Accounting will begin when the first specification (i.e., requirement specification) is baselined, and will continue throughout the hardware, software, or system life cycle. Configuration Status Accounting provides a list of the contents of each product's delivery and associated documentation.

Configuration Status Accounting records will include the identification of the initial hardware, software, or system and associated documents, and the current status, status of evolving Baselines, status of proposed and approved changes, and the implementation status of approved changes. Configuration Status Accounting will provide periodic reports as defined in the CMP.

6.6 Configuration Authentication

Configuration Authentication shall only be performed when required by the CMP. Configuration Authentication is accomplished by performing a Functional Configuration Audit (FCA) and a Physical Configuration Audit (PCA).

6.6.1 Function Configuration Audit (FCA)

The FCA ensures that the actual performance of the Configuration Item complies with the requirements stated in the baselined documentation. The FCA will evaluate the test methods, procedures, reports, and other engineering design documentation

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(e.g., requirements traceability matrix). An audit report documenting the results of the FCA will be prepared.

6.6.2 Physical Configuration Audit (PCA)

The PCA is the examination of the as-built version of the component against the baselined technical documentation defining the component. The PCA will ensure that changes to be included in the version of the delivered product are included, and that all required items of hardware, software, system, data, procedures, and documentation are included. An audit report documenting the results of the PCA will be prepared.

7.0 Metrics

There are no metrics associated with this SLP.

8.0 Records

Records identified by the CMP will be kept in accordance with the CMP and the applicable project plan. An electronic documentation system may be designed to accommodate record keeping.